Section 5.1

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"Critical thinking is thinking about your thinking while you're thinking in order to make your thinking better."

- Richard W. Paul

Fair Bills?

The U.S. government authorizes private contractors to audit bills paid by Medicare and Medicaid. The contractor audits a random sample of paid claims and judges each claim to be either fully justified or an overpayment. Two SRS's were chosen, 30 small claims and 30 medium claims. We want to answer the question, "Does the chance that a claim is judged to be an overpayment depend on the size of the claim?"

	Small	Medium	Total
Overpayment	14	8	22
Fully Justified	16	22	38
Total	30	30	60

Explanatory Variable

(1) What is the explanatory variable?

A How a claim was judged (overpayment or fully justified).

B The size of a claim (small or medium).

C The proportion of claims that were judged to be overpayments.

D Whether or not a higher proportion of medium claims are judged as overpayments.

E None of the above.

(2) What is the response variable?

A How a claim was judged (overpayment or fully justified).

B The mean number of overpayment claims.

C The proportion of claims that were judged to be overpayments.

D Whether or not a higher proportion of medium claims are judged as overpayments.

E None of the above.

(3) As for any 2×2 table, there are two pairs of conditional proportions. For this table, the two pairs are 14/30 versus 8/30 and 16/38 versus 14/22. Which pair corresponds to the question of interest?

A 16/38 and 14/22 because this shows the relative risk of a small claim being an overpayment.

B 14/30 versus 8/30, since those are the proportions of successes (overpayments) in each group (small or medium sized claims).

C Neither, 22/60 is the correct proportion to consider for overpayments.

D None of the above.

College Pride

Think about the proportion of students at your college who are wearing clothing that displays the college name or logo today. Also suppose that a friend of yours attends a different college, and the two of you have a recurring discussion about which college displays more school pride. You decide to measure school pride by the proportion of students at the college who wear clothing that displays the college name or logo on a particular day. You want to investigate whether this proportion differs between your college (call it Exemplary Students University, ESU) and your friend's college (call it Mediocre Students University, MSU).

(4) What are the observational units? As always, be as specific as possible.

A Clothing, with or without college logos.

B The two colleges.

C Students at both schools who wear clothing with college logos.

D Students at both colleges.

E None of the above.

(5) What is true of the response variable?

A It is not categorical.

B It is which school has more pride.

C It is whether or not a student is wearing clothing that displays the college name or logo.

D It is how many students are wearing clothing that displays the college name or logo.

E It is which school a student attends (ESU or MSU).

(6) Would you use random sampling to select the observational units? If so, explain why.

A Random sampling ensures that causation can be implied.

B Random sampling let's us make inferences to all college students.

C Random sampling let's us make strong conclusions about only the samples selected.

D Random sampling ensures that each student at both colleges has an equal chance of being selected.

E Two of the above are correct.

(7) Would you use random assignment to create the two groups to compare in this study?

A Yes, this will ensure the proper ratio of logos for both colleges.

B Yes, random assignment and random sampling are needed to make generalizations to broader populations.

C Yes, random assignment ensures that observational studies are conducted properly.

D Two of the above are correct.

E None of the above.

(8) Why are conditional proportions used in the types of studies discussed in Chapter 5?

A They allow us to compare the percentages of successes in samples of different sizes.

B They allow us to determine the proportion of successes conditioning on a given level of the response variable.

C They allow us to conclude that one categorical variable causes the other categorical variable to occur regardless of study design.

D Two of the above are correct.

E None of the above.

(9) What is relative risk?

A The chance of error that is taken every time you gather a sample

B An indication about how many times greater the risk is of an outcome compared to another

C $\hat{p}_1 - \hat{p}_2$

D π_1/π_2

E None of the above

Key Terms and Ideas to Understand in Chapter 5

- **Section 5.1**
  - Observational Unit
  - Explanatory Variable
  - Response Variable
  - Two-way Table
  - Conditional Proportions
- **Sections 5.2/5.3**
  - Association/no association
  - Random assignment
  - $\pi_1 - \pi_2$ (Parameter)
  - $\hat{p}_1 - \hat{p}_2$ (Statistic)
  - p-value
  - $2SD$ CI for $\pi_1 - \pi_2$
  - Shuffling the response